Q. Now, what would be -- maybe you could walk us through what a typical artesian phenomenon might sort of --

A. It probably -- if it's all right, I can talk about that when we talk about the proposed well completion for the oil and gas wells.

Q. Sure.

A. Just wanting to kind of lay the foundation for the artesian waters.

Q. Okay. This slide is titled Summary of Water Supply Well Depth and Water Levels.

A. These are some of the information of wells in the area, you know, over the Rio Brazos down into the TA Creek and around Tierra Amarilla. I got this right off the State Engineer's Waters Database web site. So all of these are water supply wells that they have records of. Of course, there's many more, as we talked about earlier.

But the thing -- what I did was I sorted them by well depth. And so you can -- some of them are as shallow as 10 feet and then others are over 1,000. And this for a mutual domestic community water system. And those -- the reason why those wells are deep for that community water system is because they had to go to a more reliable source of water that was deeper.

And so there you can see there's a wide range of depths. And what I'm trying to say there is, water all down

through those depths is used for water supply -- or wells have been constructed at various depths throughout not only the alluvium, but the Mancos Shale and the Dakota Sandstone.

Q. Okay. Anything else on this slide?

A. Nope.

Q. This slide is titled Proposed Well Drilling Methods and Construction. What can you tell us about this slide?

A. Based on information from the four permits, as this is a similar table -- I have the AIP number, the name, the location, and the elevation, and then the proposed depth. And you can see there's three that are proposed for a 2,000 depth and one that goes to 6,000 feet.

And these are the way -- what's shown on the permit is that they are going to drill a 12 3/4-inch hole, I believe. I think that's a standard bit size. And then they're going to put in -- to 350 feet -- and then they're going to put in a 9 5/8-inch casing -- or 7/8-inch casing -- almost a 10-inch casing, and then they're going to cement that in place, which is good.

But the issue I have with that proposed completion is that the annulus is not thick enough for an appropriate cement seal to protect upward flow of waters into another formation.

Q. And why is that? If you need to, we have a piece of paper and you could draw us a picture. But if you feel more

comfortable in describing why that's inadequate --

A. Well, if there's only an inch annulus, you're going to try to put a cement seal in over 350 feet. That's -- and sometimes the hole is not perfectly straight. That casing will be --

MR. HALL: I think I'm going to interpose an objection at this point. He's not been qualified as a drilling engineer, well completion engineer.

MR. A. TRUJILLO: Mr. Finch, would you care to elaborate to Mr. Hall your experience in drilling?

THE WITNESS: Yes. I've been involved with hundreds, maybe even a thousand water supply wells across the State of New Mexico up to 5,000 feet in depth. And I've also assisted the City of El Paso with their $2 million injection wells that were 4-5,000 feet in depth.

MR. HALL: Any casing or cementing programs?

THE WITNESS: Yes. Casing and cementing programs.

MR. HALL: For oil wells?

THE WITNESS: Pardon me?

MR. HALL: For oil wells?

THE WITNESS: Just for injection and water supply wells.

MR. BROOKS: Well, I'm going to overrule the objection. We'll allow the testimony for whatever benefit it has.

Q. (By Mr. A. Trujillo): Mr. Finch, will you finish letting us know what you feel is inadequate about the applications that Approach has submitted in terms of their casings?

A. If there are artesian conditions, the State Engineer will require a two-inch -- I think it's approximately two, two-and-a-half inch annulus for a water supply well for it to be a cemented surface casing. And all I'm saying is that these are not up to those standards for a water supply well for the same kind of conditions.

Q. And that is to prevent water from coming to the surface?

A. Right. That is to prevent commingling of aquifers. And also, if there's fresh water, you don't want it coming up and flowing out of the ground if it's artesian, because then you're wasting water. And one of the State Engineer's requirements for a water right is to conserve water. So it's contrary to conservation.

MR. BROOKS: I want to interject and ask a question because I didn't quite follow what you were saying. I thought you said -- and I had not seen the schematics for these permits -- but I thought you said that they were going to drill a 12 5/8-inch hole, correct?

THE WITNESS: It's a 12 1/4 or something like that. I have the numbers in my --

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Q. (By Mr. A. Trujillo): Mr. Finch, why don't you refer to --

A. My technical memo?

Q. Either that or the application.

A. Right.

MR. BROOKS: The application should have schematics attached.

Q. (By Mr. A. Trujillo): Why don't we turn to Exhibit No. 4.

A. Is that the County's exhibit?

Q. County Exhibit No. 4.

A. Okay.

Q. Now, Mr. Finch, this is titled Application for Permit to Drill, Re-enter, Deepen, Plugback or Add a Zone, and it appears to have been submitted on the Sena property. Now, do you see the proposed casing and cement program on second half of this page?

A. I do. It's for the first entry for hole sizes, 12 1/4-inch, and then there's a 9 5/8 casing. And then that says a setting depth of 320 feet.

MR. BROOKS: Okay. Now, do you know if that 9 5/8 is the outside diameter or inside diameter?

THE WITNESS: You know, it doesn't specify.

MR. BROOKS: If it were outside diameter, you would have somewhere close to 3-inch annulus, right?

MR. A. TRUJILLO: Mr. Hearing Examiner, I'm going to have to object to you testifying in this matter.

MR. BROOKS: I'm asking the witness questions.

MR. A. TRUJILLO: I believe you stated a fact to him.

MR. BROOKS: I posed a hypothetical. And I'm overruling your objection.

THE WITNESS: My understanding is it's a 3 inch. Essentially you divide that by two and that would be your -- the actual annulus. Because you're looking at the space in a diameter setting. So if you have 12 1/4 inches, 9 and whatever, the total on either side combined is three inches. And you divide that by half and end up with an inch and a half.

MR. BROOKS: Thank you. You may continue.

Q. (By Mr. A. Trujillo): So what you're saying is that --

MR. HALL: I'm going to object. It's looks like we're about to start leading the witness.

MR. BROOKS: Well, you need to let the counselor ask the question before you object.

MR. A. TRUJILLO: You're objecting because I'm about to do something?

MR. HALL: Sorry.

Q. (By Mr. A. Trujillo): Now, Mr. Finch, what are you saying, then, in terms of the hole size as it relates to the casing size as listed on all of Approach's applications?

A. I believe they're all the same.

Q. Now, how does -- go through the -- let me see.

A. They were all the same. It says that in my technical memo, and that's what I got from the permits. Now, this is just for the four permits.

Q. Mr. Finch, do you have a calculator I can borrow?

A. No.

MR. A. TRUJILLO: Mr. Hearing Examiner, if you could just give me one minute.

Q. (By Mr. A. Trujillo): Mr. Finch, let's get to the bottom of this, then. Mr. Hearing Examiner hypothesized to you the inner diameter versus outer diameter. Could you maybe go through that analysis for us?

A. Well, casing, depending on what type of casing it has, has specifications for inner and outer diameter. And typically, in the water well industry, a 14-inch casing, that's the nominal -- which means it's approximate -- is the inner diameter and the outer diameter is larger because of how thick the steel material is. It could be 14 inches and 3/8 or something.

Q. Okay. Now, in terms of the hole size and the casing size, what did you base your calculations on in terms of the inner and outer diameter? Can you explain that for us?

A. I assumed that the hole size is the hole size. There's no inner or outer there.

Q. Right.

A. And that the casing was the outer diameter. What's specified on the permit is the outer diameter of the casing.

Q. Okay.

A. It doesn't say on the permit if the casing size -- if it's the inner diameter or the outer.

Q. Okay. Let's leave it at that. What else can you tell us about this slide?

A. Oh, I have a list of potential sources of waste and contaminants that can be associated with oil and gas drilling. And, you know, the OCD has made great strides with the new Pit Rule to contain a lot of these fluids and to protect the environment. But there are things outside of pits related to the operations of drilling, such as fuel and the equipment itself. You know, there's hydraulics related to the equipment, and service rigs and other types of things that can, you know -- you can have a malfunction or something happen and you can have a release.

So just the Pit Rule itself doesn't cover everything. There's things related to the operation that can also produce potential sources of waste and contaminants.

Q. Now, were you here for opening statements?

A. I believe I walked in on them.

Q. Were you here for Mr. Hall's opening statement?

A. No, I was not.

Q. Mr. Hall indicated that Approach has asked for closed-loop systems. Have you had an opportunity to examine the applications in any detail?

A. No, I have not seen the applications for the closed-loop systems. The permits and even some of the applications all implied -- or most all of them implied -- a synthetic liner, a pit with a synthetic liner of 6 to 12 millimeters.

Q. Now, implied -- I want to be a little more clear there.

A. Well, they stated. That's what was marked on the permits.

Q. Well, if you could turn to Rio Arriba County Exhibit No. 2.

MR. A. TRUJILLO: At this time Your Honor -- Mr. Hearing Examiner -- I would move for the admission of Rio Arriba County Exhibits 2 through 5.

MR. HALL: No objection.

MR. BROOKS: 2 through 5 are admitted.

[Applicant's Exhibits 2 through 5 are admitted into evidence.]

Q. (By Mr. A. Trujillo): Now, Mr. Finch, half way down the page there is a box that says "pit," and there is another little box that says "closed-loop system." Will you

please tell us which is checked?

A. Closed-loop system is not checked. And a pit with the synthetic liner is checked. And it says the liner will be 6 milliliters thick -- millimeters thick -- excuse me -- if I read that right.

Q. I believe it's 6 -- is it millimeters or is millionths of an inch?

A. I can't -- this has a -- I'm not sure what that stands for there.

Q. Am I --

A. It's hard to read on this. This is fuzzy. I'm not sure what the abbreviation is for.

Q. Let's go, then, to No. 3. And this is -- Mr. Finch, just for the record, could you let us know what Exhibit No. 2, who that property owner was? It's at the top, property name?

A. Oh, Sultemeier.

Q. Okay. And now No. 3, who is the property owner in this application?

A. Sena.

Q. Okay. And so this -- I'm sorry, Mr. Finch. Could you turn back one more time to No. 2? And in the bottom right-hand corner where it says Oil Conservation Division, do you see a signature?

A. I do.

Q. Does it indicate to you that this application has been approved?

A. It does.

Q. Now, let's turn to No. 3. Do you see a signature that indicates that application has been approved?

A. Yes.

Q. Now, is this application approved for a closed-loop system or for a pit?

A. For a pit.

Q. And how thick is the pit liner in that one?

A. Six -- whatever those units are.

Q. And the property name was?

A. Synthetic liner.

Q. No, the property owner was?

A. Sena.

Q. Let's go ahead and go to 4. At the bottom right-hand corner of No. 4, do you see a signature from the oil and gas -- the deputy oil and gas inspector?

A. I do.

Q. Now, is this application approved?

A. Yes.

Q. Now, is this application for a pit or a closed-loop system?

A. It's for a pit. But the thickness of the liner seems to be different.

Q. We won't even speculate what that says. Who is the property owner?

A. Sena.

Q. Okay. Now, let's go to No. 5.

A. Okay.

Q. Same thing, bottom right-hand corner. Is this application approved? Is there a signature?

A. There is.

Q. Now, is this application for a closed-loop system or for a pit?

A. For a pit.

Q. And who's the property owner here?

A. The Woolley family.

Q. Okay. Now, let's go to No. 6. Is this application approved?

A. It's not signed.

Q. Okay. So it's not approved, then?

A. It doesn't look like it.

Q. And this application for a pit liner or a closed-loop system.

A. For a closed-loop system.

Q. So we have one. Okay. Let's go to No. 7. Now, this application -- I'm sorry. Did you say the property owner name for No. 6?

A. The property owner is Sultemeier.

Q. So Sultemeier 2. Now, in Exhibit 7 -- now, this application, has this been approved?

A. No.

Q. And is this application for a closed-loop system or for a pit?

A. For a closed-loop system.

Q. For a closed-loop system. And this application, who's the property owner?

A. Trujillo.

Q. Were you here this morning when you heard Mr. Hall indicate that this closed-loop system application had been withdrawn?

A. Yes.

Q. Now, let's turn to No. 8. And is this application approved?

A. No.

Q. And is this application for a closed-loop system or a pit?

A. It's for a closed-loop system.

Q. All right, three. And who is the land owner in this application?

A. Roller.

Q. Roller?

A. I believe it says Roller.

Q. Okay. Now, let's got to No. 9. Is this

application approved?

A. No.

Q. Is this for a closed-loop system or a pit?

A. It looks like it's for a pit.

Q. For a pit, okay. And who's the application owner in this -- excuse me. Who is the owner of the property?

A. Hinkle.

Q. Hinkle? Now No. 10. Is this application approved?

A. Nope.

Q. And is this application for a closed-loop system or a pit?

A. Pit.

Q. Okay. And who is the applicant in this -- excuse me. Who is the property owner?

A. Garcia.

Q. And I believe this is the last one, No. 11. Is this application approved?

A. No.

Q. And is this application for a closed-loop system or a pit?

A. Pit.

Q. And who is the owner of this property?

A. Valdez.

Q. Now, Mr. Finch, how many closed-loop systems did

you see in these applications? Was it three?

A. Yeah. That seems about right, three or four. There was fewer of those than there were pits, yes.

Q. And how many of those closed-loop systems were in granted permits?

A. None.

Q. Now, is there anything else about this slide that you'd like to discuss?

A. I think we've touch on all those points.

Q. Okay. And what is this slide? This slide is titled Rio Chama Region Water Plan. What is this slide?

A. Well, this is directly -- a map, Figure 13. It's a vegetation map out of the Rio Chama Water Plan. And the reason why I used it for this slide is because it has a nice, I guess, visual of the outline of the Rio Chama Watershed in that dashed line.

And then it has the Rio Chama and the tributaries labeled. And you can see TA Creek going into this purple area and the purple is conifer forest and more of the high mountain type of environment. That's -- the slide is really -- that's all I have to point out on that.

Q. Approximately where in this slide is the area where Approach Oil has placed applications to drill oil wells?

A. In the middle of the figure there's a purple -- what do you call it -- blob.

Q. And what is that purple blob -- the legend, what is that purple blob --

A. It's subalpine conifer forest.

Q. Okay.

A. So most of the permit area is up in TA Creek in this purple area.

Q. Okay. Now, I see something in the left-hand side, "Recognizes the Importance of Water to the Communities." What is that referencing?

A. That's just a general statement. As part of my preparation for my testimony, I reviewed the Rio Chama Region Water Plan because these water plans are significant in reflecting what the community needs are for water and how they're going to ensure a reliable supply and quantity in the future.

Q. I see. Now, is there anything else in this slide?

A. No. And these next few slides are pieces of that water plan that I've taken right out of it. This is the summary of the Rio Chama Regional Water Plan planning alternatives. The plan is very comprehensive. It describes all the water resources, all the cultural aspects, it has public input, and then it becomes adopted by the Interstate Stream Commission.

And two things that are important here is that we

have one, it says protect water quality, and then protect and restore upper watershed areas. Those are the last bullet and the third to last bullet.

Oh -- also, at the very top it says, "Preserve the Acequia System and Strengthen its Role in Community Life." These are all -- these were stated in the water plan numerous times and it's the common theme.

Q. When was this Rio Chama Regional Water Plan enacted?

A. There were several drafts that were done starting -- I can't remember when it started -- but I believe the final plan was adopted and published and put on the Interstate Stream Commission web site a couple of years ago.

Q. Okay.

A. That's all I have for this one.

Q. Can you go ahead and just read some of those bullets into the record? You can skip the ones you've already read.

A. Okay. "Develop local agriculture with information, marketing and financial support. Provide reliable water supplies to community water systems. Conserve and reuse water resources where appropriate. Protect water quality. Protect and restore upper watershed areas," with an emphasis on upper.

Q. Okay. Now, this next slide is entitled Rio Chama

Water Plan.

A. Right. And I apologize for the wording, but it's the basic strategy that came out of water plan for protecting the supplies. And the strategy is to regulate and discourage development in upper watershed areas.

And I'll just read it, if that's all right.

Q. That's fine.

A. "The upper reaches of the Rio Chama mainstem and tributary watersheds are sensitive areas and need to be carefully managed. Land practices in these upper reaches have large impacts on the quality and quantity of water that reaches the streams and acequias within the entire watershed. There is general agreement in the region to restrict or even prohibit the development in these areas. If the development is allowed, it is very important to stringently regulate road design, implement runoff catchment structures, require terrain management to prevent excessive runoff, and re-vegetate all disturbed areas.

"Re-vegetation and erosion control requirements should be stringently enforced in all instances of disturbance including non-construction activities such as utility installation or logging. Adequate road construction standards are important here, as everywhere. In most upper watershed areas, we need to preserve the ability to use fire as a watershed management tool to maintain forest health and

watershed productivity without fear of damaging inappropriately stilted structures. This would tend to argue for prohibiting any development in these areas."

MR. BROOKS: I believe that said, "inappropriately sited structures," doesn't it?

A. Oh, sited. Thank you.

Q. (By Mr. A. Trujillo): Okay. I'm not sure if I want you to read this one.

A. I don't want to do that either. I'm just going to say that over in the right-hand column, starting in the seconds paragraph, the second sentence, there are recommendations on protecting and restoring the watersheds for not only the higher altitude areas, but also the low altitude areas. And they're very specific here. And this is based on all the details and information that were compiled in that water plan.

Q. Okay. Now --

A. That's it. We can go to the next one.

Q. Now, this seems to be a continuation of the Rio Chama Water Plan.

A. It is. The next slide is as well. And there's one -- I thought an important thing here mentioned in the plan is how this all gets implemented.

Q. Now, where do you find that information?

A. Directly out of the water plan.

Q. On this slide, where do you find that information?

A. Under implementation.

Q. Go ahead and read that for us, then.

A. Yeah. I'll just read the first paragraph. The second is not --

"Implementation of land use restrictions generally falls to county administration in our region, since no other government entity has jurisdiction except in the village of Chama, our only municipality, and the Jicarilla Apache Tribe. County staff would need to draw up an ordinance to be enacted by the county commission and the county would need to assume responsibility and allocate funding for enforcement."

Q. Next slide? Now, actually, before we go to your conclusions, let's go to your memorandum, Steve.

A. Okay.

Q. And I believe that is Exhibit 20 -- no, 19. I'm sorry. Mr. Finch, in going over this, there was a question -- there was a clarification -- or at least I wanted you to maybe help me understand what this term meant. And it's found on Page 3, one, two, three, four -- paragraph four.

And I'll just read it for you and you can explain it to me. "The shallow alluvium is recharged by surface water and is in direct communication."

Now, what does "direct communication" mean?

A. That means the surface water and the shallow ground water in those alluvium deposits interact. So there's -- the water will infiltrate, the surface water will infiltrate into the alluvium readily. In places the alluvium may discharge out as surface water downstream, maybe even in the form of a spring.

So they're -- they are inter-related. So if you pollute the surface water, you pollute any shallow alluvial groundwater downstream of it.

Q. Well, then, read the first sentence of that paragraph in context with what you just said?

A. "Water supply wells in the vicinity primarily yield ground water from shallow alluvium."

Q. What that means is that the water wells are in communication with the surface water in these wells?

A. Right.

Q. And is that --

A. Where those deposits are saturated with groundwater.

Q. And that's here in this area where these oil wells --

A. I've described them in most of the major valleys and arroyos, the alluvial deposits in the bottoms where they are, there's shallow groundwater.

Q. Okay.

MR. A. TRUJILLO: I pass the witness.

MR. BROOKS: Very good. At this point, let us take a --

MR. A. TRUJILLO: I'm sorry. I'm sorry. Mr. Finch has not concluded his -- I apologize.

MR. BROOKS: All right. Yes, I thought you probably would want to get --

A. I'll just go through them quick.

Q. (By Mr. A. Trujillo): No, no. Don't go through them quick. I'm sorry.

A. They're very simple.

Q. What are your conclusions, then, of this preliminary analysis of the applications to permit and granted permits for oil wells in this Rio Chama watershed?

A. These are my opinions based on analysis that I presented here. And, you know, the Rio Chama Regional Water Plan is a very strong, convincing document for protecting those upper watershed areas. And I think that should be considered. That is no different than what the Forest Service is doing right here in Santa Fe where they have a municipal watershed that's protected from any kind of development. As a matter of fact, people can't even hike in there. Maybe it doesn't need to be that stringent, but there's examples of where this kind of thing takes place, this level of protection for surface and groundwater. And the water plan is the basis for all of that.

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The second bullet is -- I really think you need for these permits on these, or these applications, a well siting analysis needs to go along with it before the permit is issued. And this should be a field investigation as well as looking at existing information. Mainly, for this area where we have such a viable resource of water as in the Rio Chama watershed.

And then if you're going to do anything -- drill -- use only closed-loop systems. I think that's becoming -- with the new Pit Rule, that's already in place.

The last bullet item is to -- I think the OCD may want to consider requiring a better annular seal for the surface casing for these wells to prevent upward migration of saline water or commingling of aquifers. And that would help protect the groundwater.

Q. Now, Mr. Finch, in terms of the second bullet point, would those then be individual hydrologic well siting evaluations before issuing drill permits?

A. Yeah. Because you don't want to do it after the fact. I think that's what happened at Sultemeier No. 1.

Q. And what do you mean "after the fact"?

A. Well, I mean, before you even build a pad or do anything, you need to look at where you're going to put it. And maybe that well would have been found, and you would have known that you were -- whatever it is -- 50 feet from an existing water supply well.

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MR. A. TRUJILLO: I pass the witness.

MR. BROOKS: Okay. Let us take a 15-minute recess.

[Recess taken from 3:28 p.m. to 3:45 p.m., and testimony continued as follows:]

MR. BROOKS: Okay. We'll go back on the record. We, according to my calculations, Rio Arriba County has remaining 2 hours, 22 minutes, and Approach has remaining 5 hours, 26 minutes. That's a total of 7:48, of course, because I would like to get at least halfway through with the allotted testimonial time today. We'll need a little over an hour and a half to do that. We'll need close to two hours to do that. So I would like to go to about 5:30 this afternoon. Does that create a hardship for anyone?

MR. HALL: No.

MR. A. TRUJILLO: No.

MR. BROOKS: Okay. Very good. Mr. Hall, you may cross-examine.

MR. HALL: Thank you, Mr. Examiner.

CROSS-EXAMINATION

BY MR. HALL:

Q. First, Mr. Finch, let me address your Exhibit 19, you're technical memorandum, if you have that in front of you.

A. I do.

Q. As I understand it, the only difference between what was contained in the exhibit notebook and what was handed

out here today was the date only; is that correct?

A. Yeah. Just the date on the first page.

Q. Okay. On the second page of your technical memorandum, you created the maps, is that right, from Topo Resources?

A. And my staff helped me as well, on some of these.

Q. Did you locate any of the previously existing oil and gas well bores on this here?

A. No, I did not.

Q. Did you know that any existed?

A. I know that there are some in this are, in the county.

Q. In the vicinity of your map area?

A. I do not know where they are in relation to this map.

Q. Okay. Did you check to see if there were any?

A. I did not.

Q. Would that have any bearing on your conclusions at all?

A. Well, any additional information may have some bearing on my conclusions.

Q. Okay. Page 3 of your technical memorandum, you list the number of designated uses by the Water Quality Control Commission. Do any of those designations result in the restriction of the siting of any of the facilities of any kind?

A. Pardon me? I didn't quite --
Q. Page 3 of your technical memorandum.
A. Right.
Q. There are a number of designations you have listed there.
A. That's correct.
Q. Pursuant to the Water Quality Control Commission designations. Do you see that?
A. Yes, I do.
Q. Do any of those designations restrict the construction of facilities in those designated areas, facilities of any type?
A. These aren't areas for designated uses.
Q. Do those designations restrict construction of surface facilities of any kind?
A. I guess I believe there are many agencies -- and this maybe a better question for your expert -- but there are many agencies that adopt these standards set by the New Mexico Water Quality Control Commission, and they use those standards too in their permitting process. So there may be, I'm just familiar with --
Q. You're not aware?
A. I'm not aware of all the details of every agency that uses these standards.
Q. You're not aware whether those act as

restrictions, then, on surface use?

A. No, I'm not aware of it.

Q. Okay. And I notice on Page 7 of your report, it says in the very first sentence, "Depth to groundwater for each NMOCD well permit location cannot be determined without site-specific data."

You didn't visit the well sites, did you?

A. No, I did not.

Q. Are you aware of whether any of the staff of the OCD visited any of these well sites in reviewing the permit application?

A. There's nothing on the permits or the applications that would indicate there was a site visit. My information is purely based on those permits and applications.

Q. So the answer to my question is, no, you don't know if there were?

A. I'm not aware of anything.

Q. Your Exhibits 2 through 12 that we ran through, the drilling permits and APDs, you're familiar with that terminology?

A. Exhibits 2 through 12. Yeah, I remember all that.

Q. You don't need to refer to them, but let me ask you, do you know whether Exhibits 2 through 12 are complete. Are there any more regulatory filings associated with these

exhibits?

A. One thing I did look for is if there's any conditions of approval. I never saw where that box was checked under the OCD Division. And since there wasn't a closed-loop system, I never saw an application related to these permits.

Q. Okay.

A. So this is all I'm aware of in relation to these permits or applications.

Q. Okay. So you don't know whether these are complete; is that correct?

A. Well, if it's been signed and approved, I would say that it should be complete.

Q. What's a C-144?

A. I'm not intimately familiar with the forms and titles of forms for at least all of them, for the OCD.

Q. All right. Are you familiar with the permit application for pits that the Division is now using?

A. The new Pit Rule?

Q. Yes, sir.

A. I have some familiarity with it, yeah.

Q. Are you familiar with the form?

A. I'm not familiar with the form.

Q. Okay. Now, I get to ask you about your casing and cementing design experience. I'm interested to know about the 5,000-foot water well you drilled. Where was that?

A. That was in the San Juan Basin.

Q. Was that drilled with fluids; do you recall?

A. I don't recall. It could have been air, but I don't remember.

Q. Were you just involved in the design of the casing and cementing program for that well?

A. No. I'm a geologist. We don't design. We specify.

Q. Were you involved in creating those specs.

A. We work with engineers and we provide specifications.

Q. Okay. Do you know what type of cement was used for that particular drill?

A. I don't recall.

Q. Do you know what -- you don't know about the compressibility or the mix?

A. No. That was probably 20 years ago.

Q. You don't know the injection rates?

A. No, I don't.

Q. Is the rate of injecting cement a concern when you're drilling through water bearing aquifers?

A. Rate of injecting cement? Usually when we're drilling in aquifers, we don't inject cement or --

Q. It's the pumping rate.

A. I don't understand your question.

Q. You don't know?

A. No, I don't know what your question is.

MR. A. TRUJILLO: I'm going to object. I don't recall hearing a question, either.

MR. BROOKS: Well, I think that the witness was in the middle of an answer and Mr. Hall went on to another question and then this conversation arose. So I suggest we proceed to the next question.

UNIDENTIFIED PUBLIC MEMBER: Mr. Hearing Officer?

MR. BROOKS: Yes?

UNIDENTIFIED PUBLIC MEMBER: Would you have people speak up a little louder? Because it doesn't make it back here as far as being able to hear. I would appreciate that.

MR. BROOKS: Okay. I shall endeavor to do so, and hopefully others will also. Go ahead.

Q. (By Mr. Hall): As far as you know, can you tell us whether the casing and cementing program proposed by Approach for its wells complies with the OCD's casing and cementing and drilling requirements?

A. I don't know. All I know is that these four permits were approved as they are written here.

Q. Okay. Could we go to your slides, please, sir? I have some questions about them. Your fourth slide was the boundary map for the headwaters of the Rio Chama?

MR. A. TRUJILLO: I'm sorry, Mr. Hall. I didn't

catch that. Is this the --

MR. HALL: This is the right one.

Q. (By Mr. Hall): The boundary for the entire watershed is depicted by the hatch line, correct?

A. That's correct, yes, of the Rio Chama. It's also the planning boundary for the Rio Chama Regional Water Plan.

Q. Okay. How was that line determined? Is that a function of elevation?

A. It relates to drainage divides. Not necessarily elevation, but elevation does play a role.

Q. And so the Rio Chama Watershed itself includes lands to the west of the Rio Chama, of course?

A. That's correct.

Q. And are there oil fields located in that portion of the watershed?

A. I know there are some out west, but I don't know where they are in proximity to the watershed boundary.

Q. Are you familiar with the El Poso field?

A. No.

Q. On the immediate west side of El Vado Reservoir. Have you seen that?

A. No, I have not.

Q. Are you familiar with the east and west Puerto Chiquito Mancos fields?

A. I'm not familiar with -- I may be familiar with

them in the sense of a location and a map, but not by a name.

Q. Do you believe that the drilling protocol you're recommending in this case for the Approach wells also ought to apply to wells drilled in the west side of the watershed?

A. No. I differentiate the west side from the east side of the Rio Chama, that is. And in my testimony I noted that the west side of the Rio Chama has an insignificant amount of surface water as compared to the east side. And I was trying to draw that distinction because there is that distinction. And that's why the east side is more important from a watershed protection standpoint than what you would see on the west side.

Q. All right. But there are still surface flows into the Rio Chama from the west side of the watershed?

A. There are some. And some of them even have individual stream standards that are different than what I have in my Table 2 of Exhibit 19. Am I right?

Q. That's your next slide, right? The stream standards?

A. Yes.

Q. Could we get to that, please? This is tributaries above El Vado, correct?

A. Right.

Q. East and west sides?

A. There are -- like I said, I believe they are

below El Vado, but there are some tributaries from the west that have different standards, and I believe them to be below the El Vado Reservoir.

Q. Is it fair to say that summary recommendation in your report is that we got to do closed-loop drilling for these wells? Refer to Page 8 of your report, if you like.

A. Right. That's one of the recommendations.

Q. Okay. And are you recommending that protocol for wells drilled on the west side of the Chama Watershed as well?

A. I think it's a site-specific analysis. That's the other thing that the proposed Pit Rule -- or not proposed anymore -- the Pit Rule spells out is that you have to do a site analysis. And so you can't just say this region or that region. That's what gets you in trouble. If you're going to do it right, you have to go out to each individual site that you're looking at to see if you comply with the Pit Rule, and if you need a closed-loop system or not.

Q. And so you are recommending site evaluations for all watersheds in Rio Arriba County, then?

A. I think it would be a good practice for the entire State of New Mexico for the OCD to implement rather than be specific, because we have other areas that may come up like the Gila Wilderness area or over by Raton that might have similar characteristics.

Q. Are you satisfied with the siting protocol that's

been followed for the drilling of wells in the San Juan River Watershed in the western portion of the county?

A. I'm not familiar with the processes for siting of wells in that area. I believe they may differ between what types of wells they are and other conditions.

Q. Can we go to your slides, please. It's Figures 2 and 3, the aerial photographs of the well site? Where were these photographs obtained from?

A. Google Earth.

Q. I'm sorry?

A. Google Earth. It's an online network of aerial photography that you can --

Q. I'm familiar with it. I just wanted to know the source. But you have not visited this location; is that right?

A. That is correct. I've been there before, but not when -- I've driven through there and been mountain biking in that area, but I haven't been there to see the well sites.

Q. And you indicated that you thought there might be some surface water in the vicinity, ponds?

A. Based on my experience and familiarity with that type of terrain, where that is, and also the detailed study we did a few miles north on the other side of the Rio Brazos, I know what those features are and what they represent and how the hydrology of the system works.

And so, yeah, based on my experience, those are

wetlands or, you know, headwaters, so to speak, areas that are seasonally saturated and ponded.

Q. Do you have any way of knowing when this photograph was taken?

A. No. I mentioned I didn't know what the month was, but it was obviously after the snow had melted -- sometime thereafter. It tells you -- Google Earth gives you a year, which is 2003. But it doesn't tell you the exact month or day.

Q. No springs are evident on that photograph?

A. There could be springs all over that place. That was one thing in the Rio Rancho study -- the Rancho Lobo -- was that we found not only a year round spring, but seasonal springs.

Q. Could we go to the next slide, please? This slide here, Figure 3, an aerial paragraph showing the Sultemeier 1, Sena 1 and Sena 2 permit location and you describe these features in the lower left-hand quadrant as drainages. Is there any significance to that term, drainage? Is that a regulatory term?

A. It could be. I use it as a hydrologist. But each division within the state government has their own list of definitions. I'm sure one of them has it.

Q. Do you know what the Division's definition of water course is?

A. Which division?

Q. Oil Conservation?

A. No, I do not. I've looked at it, but I don't recall what it says specifically without having it in front of me.

Q. Okay. Would you call these arroyos. They're not water courses, are they?

A. Pardon me?

Q. Would you call these arroyos?

A. You could. I'm sure some people call them arroyos. You can call them -- some are perennial streams, some are ephemeral. There's a -- water course has a broad definition in my book. The Environment Department has even a broader definition.

Q. Okay. Let's look at the next slide, please. I want to know a little bit more about this. It's labeled "Groundwater Resources." That an accurate label for this?

A. No. It's a geologic map. But that's a title to key me in for what I was getting ready to talk about next.

Q. Okay. It's a bedrock geology map?

A. It's a bedrock geology map.

Q. It's not a soils map?

A. It does not have soils. It has some, you know quaternary deposits, but not all, because it's from the state geologic map which is a more regional mapping composite.

Q. Okay. Could we go to the next slide, please,

your cross section? Can you locate this cross section for us on, say, Exhibit 1? Do you know where the prime line is for that?

A. I know it's east to west through Tierra Amarilla, in that general vicinity. But I don't know if it's north or south. Tierra Amarilla is right in here. So it could be anywhere in this zone in our area of interest. The best way to check would be to look at the reference. It says, I think, from Doney, 1968.

Q. You pulled this out of the literature. Was there a reference to its location?

A. I pulled this out of the Rio Chama Regional Water Plan.

Q. Okay. Let's look at the next slide, please. This is your water supply well spreadsheet. Why did you select these wells in these locations?

A. I didn't. That's what the State Engineer's Waters Database provided me. When you search the Waters Database, you can look based on township range, or you can go through various other means and it'll -- sometimes it'll pop up different sets of wells. But this is what that particular search gave me.

Q. Was there just no available data for 28 North?

A. There was no available data for 28 North. That's correct.

Q. Tell us how you searched the database.

A. By township range.

Q. You searched all townships north and south of 28 North?

A. Right. Including 28 North.

Q. Go to your next slide, please. The text in yellow, is this yours?

A. Yes.

Q. Your discussion of fluids there, are these fluids that you would find at any drilling location?

A. Not necessarily.

Q. You wouldn't find fuels and oils for drilling rigs and equipment?

A. Yeah, you would.

Q. Okay. What wouldn't you find, typically?

A. For what?

Q. You said "not necessarily." Which of these would you not find at a drilling location?

A. Well, the drilling fluids and additives, there are various, you know, kinds for the oil and gas industry, and then there's a whole other set for the water well industry. And the water well industry usually has what they call AWWA approved additives for drilling fluids which are specifically for water wells to protect the water, the groundwater from contamination. I have no idea if that's what the oil and gas

industry uses or would propose to use for those sites or not.

Q. You mentioned the importance of controlling erosion to prevent discharges into groundwater -- surface water, rather, the acequias and rivers. Is it possible to design and construct conduits so that erosion is mitigated or prevented?

A. Well, there's two ways to do it. I mean, one is to not even take the risk. That's probably the most preventative measure.

Q. My question is: Is it possible to design and build conduits and berms under structures to divert erosion?

A. You can limit your risk through design, but you don't rule them completely out.

Q. Are you familiar with the Division's guidelines for best practices for the abatement and prevention of waste?

A. I have limited familiarity with some of that, yes.

Q. All right. Do you know enough to recommend to the Examiner whether those best practices ought to be followed by Approach in drilling these wells?

A. I would think any best practices that limit the risk would be recommended.

Q. Say again? I didn't hear you.

A. My opinion is that any best practices that limit the risk for disturbing area, minimizing your footprint, and

disrupting water quality and flow would be recommended.

Q. Okay. The last page of your memorandum, Page 8 there, is it fair to say that what you've said here is that you perceive the greatest risk for contamination is from pit fluids?

A. No. That's a risk, but I think the greatest risk is from not just these 10 wells, but the potential for development of numerous wells on a 40 grid spacing plus everything else that would follow.

Q. And you are speculating about 40 acres.

A. Yeah. Whatever the pattern would be based on a discovery and the OCD regulations, if there was a discovery.

Q. Do you know enough about the geology of the area to anticipate what likely drilling density might be in the area?

A. I don't know, but I know enough to realize that you would likely be targeting some of the same formations or adjacent formations that fresh water supplies are found. And that it is possible that oil or gas wells may need to be doing some type of hydrofrac procedure to get production, which may not be the best thing to do there. Those are some of the things that are off the top of my head.

Q. For the nine wells that are the subject of this proceeding, in your opinion, is closed-loop drilling indicated?

A. That's one of them. If you find a place that's

appropriate as far as a site goes, and then closed-loop system would be the next thing to follow.

Q. And if closed-loop drilling is utilized, will the need for the construction and use pits be obviated?

A. I'm sorry. I didn't catch that last part.

Q. If closed-loop drilling is utilized, will the need for the construction and use of pits be obviated?

A. Yeah. Except for the one that's already there at the Sultemeier No. 1.

Q. It's not been used, has it?

A. I don't know. It's got fluid in it and I don't know what it's from.

Q. Did you sample the fluid?

A. No, I did not.

Q. Do you have reason to believe that it's anything other than rain water?

A. I have no idea.

Q. Okay.

A. I've seen on the photos that there is a pit there.

Q. Yeah. There's been no well drilled there, right?

A. It looks like there's surface casing or something like that and a culvert in place.

MR. HALL: That concludes my cross, Mr. Examiner.

MR. BROOKS: Okay. Do you have redirect?

MR. A. TRUJILLO: Yes, I do.

MR. BROOKS: Okay.

REDIRECT EXAMINATION

BY MR. A. TRUJILLO:

Q. Now, Mr. Finch, in your experience with water well drilling, let's talk about those casing and sealing requirements they have. Approach has submitted applications -- 10 applications -- that carry 12 1/4-inch casing -- 12 1/4 holes -- excuse me -- with 9 5/8 casing. Do you agree?

A. That's what it says on the permits.

Q. Now, you previously testified that that is inadequate.

A. I believe it's inadequate.

Q. Now, in your experience as a water well driller, would those wells past muster or would the casing of these wells past muster?

A. Well, my main concern -- I guess the answer is no. And the reason why is my main concern is, that you are drilling through shales with air, which you're likely using some type of water and foam or something. That's what they propose is air. They may have to go to mud eventually in the Mancos. But you'll get some swelling so your hole diameter in places will be less than this 12 1/4. And, I mean, getting a seal to -- an appropriate seal -- I don't even know if a bond log would pick up all that, but --

Q. You don't know that what?

A. There's a method of determining if you have a good seal. It's called a bond log.

Q. Okay. What's a bond log?

A. It looks back in behind the casing to see if you have cement, in simple terms.

Q. Okay.

A. And so I would have to be convinced that this would have an adequate seal through some kind of demonstration like that.

Q. Okay.

A. I don't believe it's a big enough annulus to have an appropriate seal through this type of formation and drilling method.

Q. In water well drilling, are there specific specifications for these annular seals?

A. There are, especially for artesian wells.

Q. Okay. And what are those specifications?

A. I know it's greater than two-and-a-half inches. The State Engineer on their website has a manual for drilling construction of water supply wells. Without having that in front of me, I can't tell you all the details, you know, it's very specific.

Q. What is the annular seal here, if you can tell us that?

A. It's less than an inch and a half.

Q. And you mentioned the State Engineer has their standards for water well drilling. Are they greater or less than an inch and a half?

A. It's greater than two inches.

Q. Okay. I'm going to hand you -- these are the Oil Conservation Division's rules and regulations. And Mr. Hall, we'll be referring to Regulation 19.3 -- excuse me -- 19.15.3.106, sealing off strata, and 19.15.3.107, casing and tubing requirements.

Now, Mr. Finch, I want you to look through those briefly and tell us if you see an numerical standard for oil well drilling in the OCD regulations.

A. I don't see any annular space requirements, if that's what you're after.

Q. I want to know if there's a -- you have the State Engineer regulations here for drilling a water well and you have the Oil Conservation Division's regulation for drilling an oil well. Now, the State Engineer regulations say you have an annular seal of at least two and a half inches to prevent water from coming to the ground. Does the Oil Conservation Division have a similar numerical standard to prevent Mancos Shale, oil, produced water, or anything else from coming up to the ground?

A. No. The only thing here it says it shall be adequately protected by methods approved by the Division.

Q. Say that a little louder. Adequately --

A. "All fresh waters and waters present of potable value for domestic, commercial, or stock purposes, shall be confined to their respective strata and shall be adequately protected by methods approved by the Division."

And then it says, "Special precautions by methods satisfactory to the Division shall be taken and drilling abandonment wells to guard against any loss of artesian water." And then it goes on.

Q. So --

A. It's up to the OCD to -- it's like a discretionary thing, is what it seems like to me. But I don't know if they have -- they may have their own, if not in the regs, but they may have their own -- what do you call it -- guidelines that aren't specified in these regulations.

Q. So they have further guidelines?

A. They could. It's not spelled out in these -- in this document here, but they could have their own guidelines that I'm not aware of.

Q. Now, Mr. Finch, in your opinion, then, are the Oil Conservation Division regulations as applied to annular seal requirements inadequate?

A. You'll have to say that again. I lost you on that.

Q. Okay. In your opinion, then, are the Oil

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Conservation Division regulations --

A. These regulations here?

Q. Those regulations -- as they apply to annular seals to prevent artesian water from -- excuse me -- whatever is down there, from coming to the surface inadequate?

A. They're just -- it's very general. It says what it needs to say to protect water, but it doesn't say how you do it.

Q. Okay. You just mentioned that when you're drilling into Mancos Shale that you have to use mud.

A. You may. I'm sure -- there's all types of fluids and additives that you can use to get by with. But one issue is the swelling of the shales and stuff when it comes in contact with water.

Q. Okay. Why don't you tell us a little bit about any risks you see associated with drilling muds?

MR. HALL: Mr. Examiner, I think I'm going to object. There's no evidence at all these wells are going to be drilled with mud.

MR. A. TRUJILLO: It could be. We might as well have Mr. Finch answer his question regarding drilling additives. I think that if these four applications have been granted -- if the six are granted, the County would at least request that there be some condition applied to these applications, some of which could be that certain additives not be used, maybe that

drilling mud not be used if there's a viable alternative. And I think that Mr. Finch is at least entitled to give his opinion as to what problems he could foresee in using drilling mud.

MR. HALL: I'll withdraw the objection.

MR. BROOKS: Okay. Go ahead and answer the question.

A. Okay. I'll just go right to one of these permits, Exhibit 2.

Q. (By Mr. A. Trujillo): Which one?

A. Under drilling methods. It says fresh water brine, diesel oil-based, gas air.

Q. Which box is checked?

A. Gas air.

Q. Okay.

A. And diesel oil-based, that's obviously not a good idea in a watershed such as this. Brine, for the same reason. And I don't think you can drill this with fresh water, because of the problems I mentioned before. So they have appropriately chosen gas air, but the problem with gas air is that you still have to sometimes add some kind of fluid to make it work -- or additive. And it doesn't specify what those additives may be --

Q. What additives?

A. -- on the permit, so I just don't know. There's a multitude of things that may be used.

Q. Give us an example.

A. Foaming agents could be used.

Q. Are those toxic?

A. Some can be. Some are approved. A water well driller in Ruidoso was shut down because he was using foaming agents that weren't approved by the AWWA and that stuff was getting into -- not a live water course, but just an arroyo. So there's a lot of things that even water well drillers are subject to. But you don't know until someone provides you with a plan of what's being used. And in our municipal well projects we require all drillers to provide us a list of all the materials and additives that will be used for their drilling.

Q. In water well drilling?

A. In water well drilling for public supply.

Q. Not for private use?

A. Domestic wells are different. Because, you know, we use -- they're -- I don't think the burden is put on the individual well owner.

Q. Mr. Hall questioned you on the drainage on the Sultemeier property.

A. Right.

Q. Do you recall that drainage that starts at the top of the mountain and comes down to the Sultemeier's property. How -- is there any way to tell how often that drainage would run?

A. The best bet would be to ask the Sultemeiers. That's what I would do.

Q. Would it be seasonal?

A. Yeah. I'm sure it is seasonal, at the least.

Q. At the least?

A. Yeah. I mean, whatever -- there are certain conditions and things that you get, you know, ample snow pack, if -- what the monsoons bring you. There's all kinds of things that happen seasonally that create runoff.

Q. Okay. Mr. Hall questioned you regarding closed-loop systems and tried to imply that you -- if these -- let me see. I need to be very careful in phrasing this question. Are these well sites as you know them, appropriate for oil drilling from a hydrological standpoint?

A. Well, the Woolley Family No. 1 is a place I wouldn't. If I was a consultant to the oil and gas drilling company, I would not recommend that as a place.

Q. Any others?

A. Well, I would point out the Sena No. 2 and the Sultemeier No. 1 are very obvious locations that are just right in the middle of areas subject to storm water and erosion or sheet flow or whatever. Too much hydrologic implications.

Q. Now, I'd like to talk about the hydrologic imbalance. Now, by virtue of placing a well pad at any of these locations, what is your professional opinion as it would

apply to the hydrological balance of this ecosystem?

A. Well, it depends on the footprint and where it's placed.

Q. Let's say for the sake of argument we can make an example from the Sultemeier Well No. 1. From a hydrological standpoint, what is the --

A. Well, erosion is obviously the issue. It seems to be evident already. And then I would see it as a problem in most of the areas up at the TA Creek Watershed.

Q. And why is that?

A. Because of the proximity to water. You know, where they're located is in the bottoms of these drainages. And, you know, you just -- that's why I was recommending the site-specific study stuff to do a hydrologic analysis to determine if that's a good place for a pad or not and how it would affect the hydrologic cycle.

You know, one problem -- one thing that is spelled out in the regional water plan is to protect those watersheds to ensure long-term supply and quantity of water. And it's so evident throughout that plan, and there's a good technical argument and basis in the plan. I just touched on some of the highlights out of that thing, but the plan is a thick document. And their recommendations are to not have any development at all in those upper watersheds like TA Creek, including even new roads.

So I think a well pad would just add to that -- or you would include that in that same type of analysis. If they are saying no new roads to maintain and protect water, you know, that's a well pad site is the same thing as a new road, so it's -- you obviously have some kind of impact. That's what their analysis shows.

Q. Would a well pad placed on the Woolley property, as you know it, affect the hydrologic balance of that drainage?

A. Yeah. I mean, that's what we talked about. It's in a wetland, right? So that obviously will have some bearing on it. The big thing mentioned in that water plan, again -- I hate to harp on that or keep bringing it up -- but one of the problems with water supply in the area is the peak summer -- or the summer demands.

There's a good amount of water that comes out through the spring. We've seen that. And it's going everywhere, but it runs off fairly fast and then it starts to dry up through the summer and those acequias and the streams suffer. And there's a shortage in the supply during those months when they need it most.

And so that's one reason why they've come up with all these alternatives and recommendations to protect those watersheds. It's to try and maintain and even increase the yield so they can have the water available to promote irrigation and the things that are already established there.

Q. So would you recommend, then, a site-specific hydrological study on any present or future applications to drill oil wells in the Rio Chama Watershed.

A. Well, yeah, certainly.

Q. Now, was a hydrological study performed on any of those -- prior to filing of any of these applications by Approach Oil?

A. Nothing was presented to me. There's nothing mentioned on the permits that I'm aware of, of a particular study. There's no conditions of approval for a study. So I'm not aware of any study that related to these permits.

Q. Now, were you here for Ms. Sultemeier's testimony this morning?

A. I was.

Q. Did you hear Ms. Sultemeier testify that she was contacted by Approach two weeks ago to inform her that they were going to be taking a hydrologist onto her property?

A. I heard that.

Q. And if you turn to Exhibit No. 2, two weeks ago was when, the 20th of June? When -- when was two weeks ago, Mr. Finch?

A. June 7th.

Q. Now, what is the date of this application for Ms. Sultemeier's property? Do you see it in the bottom right-hand corner right above the signature?

A. Oh, stamped in?

Q. Yes.

A. OCD's stamp is September 4, 2007.

Q. Does that lead you to believe that this application was filed before any hydrological study was conducted on the effects of placing an oil well in Ms. Sultemeier's box canyon?

A. Yeah, it does.

MR. A. TRUJILLO: No further questions.

MR. BROOKS: Normally, I do not allow redirect -- I mean recross, however, it seems to me there were a number of questions asked in redirect that were not covered in direct. Do you wish to do recross on those subjects that were not covered in direct, Mr. Hall?

MR. HALL: Very briefly.

MR. BROOKS: Okay. You may do so. Please limit it to subjects that were not covered on direct so a perpetual motion --

RECROSS-EXAMINATION

BY MR. HALL:

Q. I do want to ask you about the hydrologic balance.

A. Okay.

Q. What does that mean?

A. Well, there's, you know -- a lot of these

measures and stuff that are required by the OCD or the Environment Department are related to protecting water quality, and the balance is more related to quantity.

Q. We've seen some of the exhibits, including some of your slides, are photographs of the fields that have been disked and plowed. Do those affect the hydrologic balance?

A. Well, yes. And they have the right to do so. The State Engineer allows that through a permitting process.

Q. It allows plowing and disking?

A. Apparently, agriculture and surface water rights the state gives -- has established a use of that.

Q. Okay. Well, here's what I'm getting at. Does plowing and disking result in any erosion that affects the hydrological balance?

A. From my familiarity with the practices of irrigators and farmers, the last thing you want is erosion because then you lose all your soil. You have nothing to grow on or with. So the first thing they're going to try to do is design their systems to prevent erosion.

Q. Okay. So the answer to my question is yes?

A. Is no. The answer, if you're -- they do not -- their practices aren't to allow erosion, it's to prevent it.

Q. Does erosion occur from plowing and disking?

MR. A. TRUJILLO: I'm going to object as asked and answered.

MR. HALL: I don't think he's answered the question, Mr. Examiner.

MR. BROOKS: Okay. Overrule the objection. You may answer the question.

A. Okay. It will provide -- it could provide erosion locally within the field. But it all depends on how the farmer applies water to his field.

Q. (By Mr. Hall): Does sheet flow occur over plowed and disked fields in this area; do you know?

A. I'd have to go and look at it. I couldn't answer that question. My recollection of visiting irrigation areas in the Chama area are that a lot of them are bermed because of the acequias themselves. It provides a natural barrier to flow into the field.

Q. Okay. You've seen eroded plowed and disked fields in this state, have you not?

A. No. I have not seen -- up in either the Chimayo or Chama area erosion problems related to irrigation.

Q. How about from grazing?

A. Now, I have from grazing.

Q. Okay. Are you familiar with -- this is getting beyond your direct.

MR. HALL: I'm finished with the witness, Mr. Examiner.

MR. BROOKS: Okay. Very good. I have a couple of

questions to ask the witness and this won't count against anybody's time, and I will be very brief.

EXAMINATION

BY MR. BROOKS:

Q. If I read your conclusions, you have two specific recommendations: One is closed-loop systems and the other is the use of, you say, a better annular seal, correct?

A. Yes, sir.

MR. A. TRUJILLO: I'm going to object to the mischaracterization of Mr. Finch's testimony, Mr. Hearing Examiner. I believe that Mr. Finch just testified that one of his primary recommendations was site-specific hydrological studies prior to applications being filed.

MR. BROOKS: Well, perhaps Mr. Trujillo, that is a qualification of the question. The word I used, which was specific, I do recognize that that's one of the things that he has recommended, and I regard that as his general recommendation. So I'm looking to the specific recommendations, because what I'm looking to hear is supposing the Division were to grant -- were to determine that they should grant these applications with some conditions, what conditions can we put on them?

Q. (By Mr. Brooks): And the two things you mentioned here that are specific in nature would be closed-loop systems and a better annular seal. Now, closed-loop systems I

think we're going to hear some more testimony about from the defendant, so I won't go into that further at the moment.

Before I go into that, there's one other question of a general nature I have for you. You have not testified to anything about depth of groundwater that I've heard.

A. I did.

Q. Well, you testified that there was some very shallow groundwater.

A. Correct.

Q. What I'm concerned with here is not how deep the depth from the surface to the groundwater, but the depth to the bottom of the groundwater. You don't have any knowledge about that in this area?

A. Well, yeah. The table of wells that I had as one of my slides --

Q. Okay. Could you call my attention to that, please?

A. Okay.

Q. Is it the table on the bottom of Page 4?

A. Yes, sir.

Q. And I believe that table is not in your technical presentation, Exhibit 19; is that correct?

A. That is correct.

Q. Could you undertake to provide to Mr. Trujillo and have him provide to us for the record a larger copy of that

slide, because the small copy that was provided here is essentially illegible, and I don't think anybody will be able make anything out of it. Could you put that slide up on the screen, please?

A. Sure.

Q. Okay. I cannot read that on the screen. Okay, there I can sort of read it.

Okay. Tell us what that indicates about how deep groundwater goes in this area?

A. Okay. You can see that the depth of water in the shallow wells is shallow, and that's because a lot of those are in the alluvium. Then you go to very bottom and there are some deep wells, 1,000 feet and even 2600. And the depth of water there is on the order of 600-something feet.

And that's because in the Mancos Shale and some of the formation under it there are these sandstones that have their own -- essentially separate units that have their own pressure.

Q. And you're saying that there is fresh water below the Mancos?

A. In the Dakota, there is.

Q. Okay.

A. The Dakota sandstone -- and then the regional water plan lists several wells that produce from sandstones within the Mancos Shale.

Q. Now, what do you understand to be the objective formation for this well? You testified to it, but I have forgotten -- for these wells.

A. It's the Graneros Shale, I believe. It's a shale.

Q. Where is that located --

A. In the sequence of geology?

Q. In the sequence, yeah, as compared to the freshwater formations?

A. It's in the bottom section of the Mancos Shale and above -- directly above the Dakota sandstone.

Q. Now, do you -- have you correlated these areas? Do you have an opinion as to whether or not there would be fresh water in formations at or below the target formation in the area where these applications have been filed?

A. Yeah. I mean, this is evidence here that there should be fresh water all the way down to the Dakota sandstone. I mean, there may be pockets of water that are saline or what they're looking for. They could find some pocket of oil or gas or something, but -- in the fractured shale, but there is fresh water in the sandstones above and below the target formations listed on these permits.

Q. Okay. That's what I was trying to get to. And I do not know precisely where these locations are or where these water well locations are, but I suppose some correlation to

that can be worked out. Although --

MR. A. TRUJILLO: Mr. Hearing Examiner, I would offer that Mr. Finch can testify right now where these locations are, just prior to --

A. It's in the townships surrounding the permitted area. I apologize. I didn't have a chance to make a map to show where these are. If I had more time to prepare, I would have loved to have had a map with these wells on it.

Q. (By Mr. Brooks): Okay. Very good. That's what I was inquiring about.

Now, let us talk a little bit about the annular seal that you were talking about. First of all, your experience is in water well drilling, correct?

A. Yes, sir. I have very limited experience in oil and gas well drilling when I was apprentice geologist in the 1980s.

Q. Okay. And there are a lot of people that have a lot of experience with oil well drilling and casing design and cementing design; is that correct?

A. That's right. It's a science all in itself.

Q. It's a specialty?

A. It really is.

Q. Now, I gathered from what you said on redirect that your primary concern was -- and when you first went into it, I had a little trouble understanding conceptually why you

would need a larger -- why a larger annular space would result in a better seal. But if I understand it -- correct me if I'm wrong -- if I understand what you said, where your concern is that you will not get the cement to fill the annular space if it's too small. Is that what you're telling us?

A. Exactly right.

Q. Okay. Very good. I just wanted to understand that. I think that's all my questions.

MR. BROOKS: Does either side have followup based on my questions?

MR. HALL: I do not, Mr. Examiner.

MR. BROOKS: Very good. The witness may step down.

MR. T. TRUJILLO: The County calls Dr. Terrance Boyle.

MR. BROOKS: For informational purposes, according to my tabulation, the County has 1 hour, 53 minutes remaining.

MR. HALL: Mr. Examiner, I wonder if I can make a request of Mr. Trujillo to have his PowerPoint slide show available to us again on Monday?

MR. T. TRUJILLO: I may have not have -- I can have the PowerPoint presentation available, but I think may not have her available. I will not have her available.

MR. HALL: Could we have the disk?

MR. A. TRUJILLO: We can provide you with the disk.

MR. HALL: Great. Thanks.

MR. A. TRUJILLO: You're going to have to find your own operator.

MR. BROOKS: Well, I suspect we have some people upstairs that can assist us if necessary. I have no idea how to do these things, but there are some people in this agency who do.

MR. A. TRUJILLO: Dr. Boyle, let me know when you're ready.

What we could do, Mr. Hearing Examiner, if it pleases you, in the interest of saving some time, I would prefer to read a list of qualifications for Mr. Boyle and submit it to Mr. Hall for his approval or objection.

MR. BROOKS: That would be acceptable.

MR. A. TRUJILLO: Dr. Terrence Boyle received his PhD from the University of Arizona in 1979. He has more than 100 scientific publications, including three books on various aspects of applied ecology, ecotoxicology, and environmental science. He was on faculty in fisheries and wildlife biology and the graduate degree program in ecology at Colorado State University where he taught the graduate level course, "Ecological Risk Assessment."

He was the editor of the international journal, Environmental Toxicology and Chemistry from 1997 to 2001, and one of the inaugural editors of the new journal, Integrated Environmental Assessment and Management. He has had research

projects in Latin America, the Philippines, and Russia, including three Fulbright Fellowships.

He has served on international boards for a number of international societies, a member of the US Man and the Biosphere Temperate Ecosystem Directorate and on the World Commission on Protected Areas and the IUCN.

Now, Dr. Boyle, is there anything that you care to add to this list of qualifications?

THE WITNESS: It would get kind of laborious, but basically my relevant qualifications for testifying here is I am an ecotoxicologist. I've dealt with environmental toxicology at the laboratory level, field assessment, and integrations of a number of assessments of impacts in the environment ranging from mining to land use.

MR. A. TRUJILLO: Now, the County would offer Dr. Boyle as an expert witness in the fields ecotoxicology and in ecological risk assessment.

MR. BROOKS: Any objection, Mr. Hall?

MR. HALL: Well, Mr. Examiner, I'd appreciate a little bit more foundation with respect to relevance to the applications here. I'm not sure why he's being tendered.

MR. BROOKS: I'm sorry. I think that the issue here is the witness' qualifications, so I will overrule the objection. The witness is qualified as requested and relevance to his testimony may be subject to objection at the time he

testifies.

You may proceed.

TERRENCE P. BOYLE, Ph.D.

after having been first duly sworn under oath,

was questioned and testified as follows:

DIRECT EXAMINATION

BY MR. A. TRUJILLO:

Q. Dr. Boyle, have you prepared -- have you had a chance to review any of the information associated with the applications in this matter?

A. I haven't reviewed the applications per se, but I did make site visits to the Rio de Tierra Amarilla, which is the proper name for this creek, on June 11th and June 13th, and I've looked up a number of documents relating to oil contamination and risk in the environment, and I've prepared this particular presentation on the basis of those.

Q. Why don't you take us, then, through your presentation?

A. Okay. Let's see here if I remember how to do this.

Okay. Just to sort of review what we're talking about, the El Rito de Tierra Amarilla is the official designated name of the water body that we're talking about. That's how it appears on USGS maps, on EPA maps and whatnot. The size of the watershed is approximately 61.3 square miles.

Land use/cover is 70 percent forest, 25 percent in rangeland, 5 percent in agriculture, and urban water surface areas, about less than 1 percent.

It's kind of unique in at least New Mexico in terms of high watersheds in that the land is completely privately owned. There's no Forest Service or BLM land in this thing. And the present status of El Rito de Tierra Amarilla, this map I've taken from the US EPA documents on the water quality. I want to summarize, if I can, several aspects of this.

This is Tierra Amarilla. This is El Rito de Tierra Amarilla. The line right here is Highway US 64 which crosses the river here, switch-backs up here and then finally gets back onto Forest Service land up here. The site set we looked at were the Woolley site, which is approximately right here -- and I'll talk about these in more detail -- the two Sena sites, which are approximately in here, and the one Trujillo site. Several things --

Q. Which was where? In the same area?

A. Yeah. Let's see if I can get this thing to -- the two Sena sites I believe are in here. And the Trujillo site was immediately upstream from John Sena's house, the ones he showed. Again, I'll show these in more detail and photographs as we come along.

But what's interesting about this particular map: Two things, one it shows the river headwaters up here. They

actually -- there's a diverse set of tributaries in this region right in here that go all along here and they all arise from small lakes and wetlands.

The second thing is in the upper sites there's very, very high snowfall. When I went up there prior to these two June trips -- I think it was in April -- looking for some places to ski, the road was blocked. And at the road block, the snow behind it is five to seven feet deep on US 64.

Q. What month was that?

A. That was about April, sometime in April. So the area, the upper area, is inaccessible except probably by snowmobile in the winter. And, again, you know, winters vary, so this last one was pretty high in snow. We may get a dry winter and whatnot. But they do usually block that road during the wintertime up there.

The second thing there is -- this is from a US EPA water document on the water quality uses of this stream, and I'll speak more of this as we go along. But basically, from this point on down as designated by that orange highlight, Tierra -- El Rito de Tierra Amarilla is impaired as a cold water fishery on the basis of several factors, which I'll go into. The upper area is now not impaired.

Q. Who makes the determination?

A. The US EPA makes that determination in this case and it's under the TMDL Program, which is Total Maximum Daily

Load. Basically there are two ways of looking at insults to or impacts to streams. One is permitted, and these are usually point sources that in this state the EPA permits based on what the toxicity of the release is, and what the water flow is. It would be like an outfall from a sewage plant or an industrial plant.

The rest of these impacts on stream ecosystems fall under the non point source designation. And these are legal terms, point source and non point source. And to address those, the EPA has come up with up this Total Maximum Daily Load where it looks at the number of insults within the watersheds of these streams, what produces them, and how to go about collecting that so they can bring the use back up into compliance. And I'll have more on this also.

But this is a very good slide here in that it shows -- you've see this before -- but basically this ribbon here is US 64. John Sena's land is approximately in this region. This is where the bridge crosses. And you can kind of see Tierra Amarilla Creek taking off here. And from here on down, again, the EPA has determined that this creek is not -- is impaired -- is not in compliance for the parameters that would support a warm water fishery.

MR. BROOKS: I thought you said cold water fishery.

THE WITNESS: Cold water. I'm sorry. Thank you.

A. And cold water fishery designation usually means

there's trout in there and trout are an extremely sensitive fish to a number of different contaminants; much more sensitive than most other groups of fish.

Again, you can see in the background here the divide, and this is the region of really, really high snowfall up here. And, according to John, there's very, very high snowfall all over here. But the road is usually blocked approximately in this region right here almost every winter.

Okay. This is the upper part of the US 64 where it gets about 9,000 to 10,000 feet. And it is in this region that the Woolley site is and that is right in here. And you've already seen this. And what you're seeing here, also, that the previous speaker brought out is there's a system of wetlands up here that actually provide the actual head of the watershed feeding the El Rito de Teirra Amarilla.

Q. (By Mr. A. Trujillo): Now, Dr. Boyle, this is a previously unseen photograph, but it is marked as County Exhibit No. 36.

Now for proper indication of this photograph, so that it may be moved and admitted into evidence -- actually, excuse me. I'm sorry. I apologize. This has already been admitted.

A. Okay. All right. The Woolley site is exactly right here. And this and in the surrounding area you can see open water and it is a complex wetland. And it's defined as a wetland because it's standing open water at least the times of

year that we were up here.

And the next four slides are going to define that as a wetland. Okay, I'm going to have a photograph of the actual stake with the Woolley on it. You're not going to be able to read the Woolley, but this is where they --

Q. And Dr. Boyle, is this -- this is a series of pictures that we to authenticate. Dr. Boyle, did you take this photograph?

A. This one?

Q. Were you present -- no. The next photograph.

A. Yeah. Well, let me just go on there because there's four slides I want to summarize here. There's -- I think I'm going to abandon that.

There's four slides here. One is where the actual stake is, the survey stake. And then immediately in this vicinity, you'll see some springs that are upwelling from that wetland. And then there's two reaches of the stream approximately here and here. Now, that's the stake in the middle of the wetland that they put that has Woolley Site written on it. I assume it's in the center, but I don't know. There's several other survey markers surrounding it.

And this is wet land, okay? And it has wetland vegetation types on it. This is maybe 30, 40 feet from it. There's typical wetland sedges and these are skunk cabbage, which is very, very typical of wetland type of vegetation. And

you can see one of the many springs popping out right there. And there in the back is the survey marker.

This is just on the other side maybe 30 or 40 feet from it also, still within that wetland. Again, typical wetland vegetation and open water where the springs are coming up.

This is a short distance, maybe 50, 60, down from that last slide, and this looks like to me a typical trout stream. For reference in size, this is a quarter we put in the bottom of the stream. So you can see what the relative size and volume of water. This is very, very good trout habitat. You can see the gravel and stones on the bottom. And probably another 100, 150 feet past that -- again, a very, very typical type of stream. This again is one of the headwaters in a complex of tributaries that go in and form El Rito de Tierra Amarilla. And this is in the vicinity very close to the Woolley Site.

Now, this is John Sena's land and John Sena's house. And I want to point out a couple of things here. One is that site that he mentioned -- and this is a repeat of that slide and it's approximately right here -- and right here you can see the contours and the striations, is one of the sites that the -- it's the old Soil Conservation Service and I keep mispronouncing the name, but I think it's National Resource Conservation Service -- what they are doing is trying to

reclaim the watershed in the light of that impairment designation by the US EPA. And there are a number of sites like this within that area. The actual well is going to be right upstream from that.

And this again, is a similar site. But what I want to point here, the Trujillo site is just maybe a quarter of a mile from this right here. And I don't have an aerial photograph of it. But it is of similar dimensions to this site right here where you have El Rito de Tierra Amarilla on one side and on the other side in approximately the same dimensions, you have an acequia. And right in the middle of that site is the survey marker for the Trujillo site. But again, that occurs off the photograph up here. But it has similar dimensions. To repeat myself, it's in the middle of the zone that's irrigated with the acequia on one side and El Rita de Teirra Amarilla on the other side.

Now, this is the upper Sena site, No. 2. As John mentioned, there are several of these reclamation efforts within these meadows up here. And again, this is by the National Resources Conservation Service. And what they've done here is fence the headwaters, the wet areas to prevent erosion and to establish a seed bank for recovery of these areas. And again, this is a response to that bad TMDL designation by the EPA. And the problem is, is that they are putting the well right above those reclamation sites. So while we are trying to

reclaim it, they're going to put an exploratory well in there.

I don't have to repeat too much of his testimony, but there's a creek, a running creek draining right here with water in it. And the access to this area would require a considerable amount of road building because of the precipitousness of the existing well. It's called Ball Breaker Hill. When we went in there, we had to use low range 4-wheel drive to get up this thing to this area. So you're not going to drag a huge piece of machinery up there without a considerable amount of road preparation and subsequent erosion.

Let me go back here, because I think this thing skipped over one of the things I want to talk about. Okay. In order to regulate streams in terms of water quality, there's designated uses on those. And there's a number of uses that are designated for El Rito de Teirra Amarilla. There's domestic water supply, fish culture, high quality cold water fishery, which has that impairment where I showed that on the lower portion, irrigation, livestock watering, wildlife habitat, and secondary contact.

Now, each one of those uses has a body of scientific data around it with generally-not-to-exceed parameters in it. In other words, the domestic water supply has a number of parameters of when you cannot drink it or it's going to be toxic to you. Fish culture the same.

High quality cold water fishery has not only chemical

parameters around it to protect it, but also physical parameters around it. Again, irrigation has certain parameters that will protect the crops, livestock watering. It's probably pretty similar to the domestic water supply because cattle are pretty similar to us in terms of what they can tolerate.

Wildlife habitat is a physical and then secondary contact is swimming. In other words, this water should have not have any chemicals in it that you would pick up through your skin that would get a toxic response. So these are legal terms, okay? These are state current uses of El Rito de Tierra Amarilla up there. And one of them is violated for a substantial reach already. And the parameters of concern within that reach -- and again, I'll show this map again, but this is the one that was highlighted in yellow/orange, the parameters of concern are turbidity, stream bottom deposits -- in other words, the physical condition of the bottom.

Do you remember I showed you the high quality stream in the upper thing that had a lot of gravel? Well, this in the bottom has a lot of sediment in it which affects the macro invertebrate community which fish depend upon for eating and also for habitat for spawning.

Okay. Now, also temperature. The temperature is too high in the stream really to support an adequate high quality cold water trout fishery. Okay. And in this EPA report, the uses that affected the high quality cold water fishery were

identified as: Range grazing and riparian wetland contributing to the erosion; removal of riparian vegetation, probably due to grazing, but some road building; road maintenance and runoff; flow regulation and modification probably due to some dams and/or acequias and agriculture.

So those are the things that the EPA has identified within this stream as contributing to the impairment status of the El Rito. Now, what we kind of are addressing here are three wells, one permitted, one proposed -- and these are the four that I visited on June 11th and June 13th. And there's an additional, I believe, six proposed. After listening to this testimony, I know there's a total of 10, but I'm not sure of what the actual proposed statuses are, and I'm sure I can be corrected by both of the counselors here.

These well sites that I visited have a high potential for impact on surface and groundwater, and in addition, potential runoff for sedimentation from the El Rito de Teirra Amarilla -- in the Tierra. This additional runoff would be cumulative to what is already being added by those parameters that I listed before. You know, the agriculture, road building, grazing, removal of riparian vegetation. So anything else is going to be cumulative on top of that. It's not going to be separate from it.

And again, just to show you where that is, this is the impaired section running from about where the highway

bridge crosses -- 64 crosses the El Rito de Tierra Amarilla down to Tierra Amarilla itself. And again, this map is taken from the EPA report.

Okay. Now, to kind of organize the existing data in my observations, I want to introduce the risk analysis paradigm. I'm not cooking this up. It has a definite long pedigree. Risk analysis was first adapted by the National Institute of Health to assess the effects of environmental stress on human health. And then by the EPA in 1992, the paradigm was used to assess the effects of environmental stress on the ecology and natural resources.

There are societies of risk analysis. One society that I belong to, Environmental Toxicology and Chemistry, has a number of publications and books on it. There are a number of books just addressing human health risk assessment and ecological risk assessment. So this is a well-established paradigm. And basically, to define it, it is a process of defining and determining the probability of the type and magnitude of threats and the impact that these threats can cause.

Now, the simple guts of risk assessment are very, very simple -- and they have to be. Underlying this is a complexity of technical data that needs to be put in here, but the simple thing is there. The beauty of it is it integrates the science very well. In fact, you may have up there on any

kind of evaluation, toxicologist, environmental chemist, physicist, hydrologist -- and if they don't have something integrating them like this, you're going to get an absolute scientific cacophony.

It's also simple enough that lay people can realize what's going on and ask common sense questions. And basically there's three components to this: Before you have a risk you have a threat or a hazard that you can identify. This is separate of anything. Is this chemical toxic? Does it have a high distribution potential within the environment? That is the type of things you would ask. And you can ask questions of physical variables also.

The second thing that you really need to consider and that is out here, and that is what is the receptor of this threat or hazard? And receptors are usually in terms of -- not always -- but usually in terms of human health or parameters of human health or some kind of ecological receptor -- fish, invertebrates, birds, elk, whatever. So those are the receptors. And in order to establish ecological risk or risk in the environment, you need to connect those two things with what is the exposure to the receptor of the threat or hazard. Anytime if you don't have one of those three there, you don't have a risk.

And that is as simple as it gets. However, when you start doing real risk analysis, there's a complexity of

technical data that you need to establish what the toxicity is, what are the chemical and physical standards for various chemicals that would predict how they behave in the environment. What is the exposure in terms of magnitude. Is it going into the air? Is it going into the water? Is it going into the groundwater? And then, is that becoming exposed to a receptor?

So that's pretty simple to me and I think it's pretty simple to people that are on various boards and whatnot. So we're really addressing -- and again, we're still on the threat or hazard portion here -- is land use disturbance in terms of road building and developments at well sites.

And the question is: Will this add sediment to the stream involved and within the already impaired section of El Rito de Tierra Amarilla. And then to look at the --

Q. Dr. Boyle: Will it?

A. I don't know. We've used several methods to kind of estimate this. I worked in a park in northern Michigan, a national park called the Pictured Rocks National Lake Shore. It was about 170,000 acres. Half of this park was in a reserve which some exploitation was allowed in terms of forestry and development. Any activity that took place in there could not affect the streams downstream that were in the fee part of the park, the owned part of the national park.

And what we did is used the universal soil loss

equation, which in a geographical information system environment, looking at layers of vegetative cover that would lead to forestry practices, soil and its erodibility -- you can classify soils and their erodibility -- slope and slope length, and then a component of rainfall. And that equation will give you -- you do all the algebra -- it will give you loss per acre of soil in terms of the mass, total loss. So you can estimate those types of things using existing data.

And I don't want to say what's going to happen up there, because there's no data. You have a wetland. You have high slopes, certainly. You have places of input from road building, from pad development. But something like that would have to be analyzed and come up with a quantitative risk analysis before you can saying that. Certainly the potential is there from the road building and the sites that we've already seen. And then where they're going to put the sites that we already designated. So that's a potential.

And again, I'm not here doing a specific risk analysis. I'm pointing out the components that need to be there. Because to do a specific risk analysis like the previous speaker said, you really need some pretty good site-specific environmental data to get an idea of what might be happening.

But in terms of the threat -- and again, this is the first box on that risk analysis -- in terms of historical

things for the oil industry, I looked up some stuff on the web. And again, the Colorado record -- not for New Mexico, but one state north -- between 2002 and 2006 there were nearly 1,000 spills of oil and gas chemicals and waste. And these include crude, condensate, produced water, other products, diesel fluid, glycol, amine, lubricating oil, hydraulic fractionating fluids, drilling muds and other chemicals. 60 percent of these spills involved produced water. 34 percent involved crude oil or condensate.

MR. BROOKS: This was in what geographical area?

THE WITNESS: This was the state of Colorado.

MR. BROOKS: Okay. Go ahead.

A. The source of this is -- again, the oil and gas accountability project.

Okay. To establish these chemicals, at least some of them or many of them have some kind of toxic response, there's another database I found. There's 172 chemicals used in oil and natural gas development and delivery in New Mexico. Now, this is exclusive of the Colorado stuff. So we're kind of overlapping here.

I'm not saying that all these chemicals were involved in the Colorado things, but they are involved in the New Mexico activities. And there's a number of -- 117 of these chemicals have skin and sensory organ toxicants. 115 respiratory toxicants. Do you want me to read this whole list, or is this

good enough?

MR. BROOKS: Well, if we could avoid reading it that would preferable because of the time.

A. Well, the point is, there's a huge number, 117 out of 172 that have demonstrable toxicity to them, okay? And they are in various categories. And I'll give you five seconds just to kind of eyeball that thing because I don't think I want to read it all. Is that sufficient?

MR. BROOKS: That's sufficient.

A. Okay. This slide establishes that there are toxic chemicals used and a number of them in the oil and natural gas industry in New Mexico.

Another one I found was spills of pit chemicals in New Mexico. Between the mid-'80s and 2003, the New Mexico Environmental Bureau -- I think it's now called the Environment Department -- recorded 7,000 cases of pits causing soil and water contamination. And this Division here released data in 2005 that shows that close to 400 incidents of groundwater contamination have been documented from oil and gas pits.

We're talking about contamination and a large number of it. So this is just defining the potential in that first box, "hazard." So this is a definite chemical hazard from use of oil chemicals within New Mexico and within the oil industry. And this is from the six wells. Three were in northwest and three were in southeast New Mexico. And this is just -- it's a

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similar type of classification that's used by CERCLA and I'll have to read that. These are agencies compiling toxic lists. Comprehensive Environmental Response Compensation and Liability Act is CERCLA. And then Emergency Planning and Community Right to Know Act is EPCRA.

So this is the federal government compiling these data. These are not -- they are good data. And basically, what's showing is the number of chemicals on the list and then toxic chemicals on the list that are over state limits. And again, if we're going back to this thing, what we've established here is number one, that there are definite threats in terms of both sedimentation and toxic chemicals. And to some degree we have established that there is exposure. These things are fugitives from pits. They are fugitives in terms of the spill in the environment.

Okay. And then just a summary of how some of the exposures can enter the environment from drilling, hydraulic fractioning, waste pits, spills, of course, and releases into the air. Many of these chemicals that are used in oil processing have a great deal of volatility. They are toxic and they evaporate. You can get an exposure that way.

Now, the receptors portion of this thing -- of the risk analysis paradigm -- is very easy to come by because we already have it built in in terms of the water quality criteria for El Rito de Tierra Amarilla. We've already done this.

There is domestic water supplies, fish culture, high quality cold water fishery, irrigation, livestock watering, habitat, wildlife habitat and secondary contact.

The receptors are humans, hatchery fish, trout, crops, cattle and horses or livestock, riparian wildlife that live in the streams or live along the streams, and any little kid that goes swimming in the Tierra Amarilla. So what we have made here is a summary that there is a potential of threats becoming risks. And again, let me underline the potential here. I'm not doing an official full-blown risk assessment of anything at this point. This is a potential for risk becoming -- threats becoming risk due to release into the environment of a suite of chemicals used in oil exploration and extraction processes that have known toxicity, and secondly, the introduction of sediment into El Rito de Tierra Amarilla from land use disturbance due to drilling pad and associate road construction.

And that's about all I can really say at this point. But, you know, it's powerful in terms of what we have seen, in terms of the well siting in that area and what the potential for contamination is, and some preliminary recommendations. But because I've been on this for about oh, a week and a half or so and I'm familiar with risk analysis -- but a formal risk analysis should be performed considering the individual threats. And by individual threats, I mean identification of

those chemicals that are used in this drilling and all those activities, drilling, pits, extraction processes or whatnot, individual threats from sediment release. And again, you could do something like the strategy we used at the Picture Rock National Lake Shore with the universal soil loss equation, the potential for transport within the environment. This is the exposure terms.

In other words, it's not enough just to say these chemicals are toxic. Well, we all use toxic chemicals. This room probably has a number of them. But are we exposed to those things directly? Then estimations of the toxicity to representative organisms, both fish, invertebrates and whoever else is identified as a receptor, found within the various use designations of Tierra Amarilla. This includes estimations of the amount of sediment due to runoff into the waterway.

So let me echo what my predecessor said. There should be some methodical way of developing siting criteria for what these wells are going to be in terms of reducing the risk to the environment. And there should be some official risk analysis done before they are permitted and allowed to drill there.

And that's the end of my presentation.

MR. A. TRUJILLO: I pass the witness.

MR. BROOKS: Okay. I believe that you were in the process of offering some exhibits when your witness kind of

interrupted you, Mr. Trujillo.

MR. A. TRUJILLO: Mr. Hearing Examiner --

MR. BROOKS: There are some exhibits that have not been offered into evidence that you want to offer?

MR. A. TRUJILLO: If Dr. Boyle would like to offer his PowerPoint presentation into evidence, then I think that would accomplish that.

THE WITNESS: Yeah. You can have it. It's on this computer and you take it off of here.

MR. BROOKS: Okay. Well, but --

MR. A. TRUJILLO: The same time it would take --

Q. (By Mr. A. Trujillo): Dr. Boyle, were you present when these photos were taken that you introduced in your PowerPoint presentation?

A. For the Woolley Site, yes. I was not in the plane when they were taking the others.

Q. Are they an accurate representation of what you saw that day?

A. Yes.

MR. A. TRUJILLO: I offer them as evidence.

MR. BROOKS: Okay. Well, they're not marked as exhibits submitted.

MR. A. TRUJILLO: They are Exhibit 45, Exhibit 46, Exhibit 47, Exhibit 48, and Exhibit 49, and Exhibit 50.

MR. BROOKS: Any objection, Mr. Hall?

MR. HALL: No objection. Is it possible for us to get copies of the PowerPoint slides, hard copies?

THE WITNESS: Yeah. You can take them off here. I'm just going to leave my presentation on this computer. So --

MR. HALL: Okay.

MR. BROOKS: Could we have a hard copy available for us by Monday where we can get it marked and admitted into evidence, if it is deemed to be admissible?

MR. T. TRUJILLO: Absolutely.

MR. BROOKS: Okay. Very good. With that, then, we'll let Mr. Hall proceed to cross-examination.

CROSS-EXAMINATION

BY MR. HALL:

Q. Dr. Boyle, you referred at one point to the EPA report. Can you identify that for us?

A. It's a 2004 -- I don't have the citation in front of me -- but it's 2004 TMDL report for New Mexico, which I think includes -- well, I know it includes -- I think it's for New Mexico, and I know it includes Tierra Amarilla Creek. It includes another stream where they have it listed as fully compliant or impaired sections.

Q. Do you know where we can find it?

A. It's on the web. If you'd like, I can look it up and I'll be here on Monday and I'll be happy to give you a citation.

Q. Can you go back to your slide that showed your list of parameters resulting in the impairment of the lower creek?

A. Yeah.

Q. Go back to your first slide.

A. First one?

Q. Your map, yes, if you would.

A. Okay.

Q. Are those symbols for mine locations?

A. Yeah, they are. And again, I lifted this out of the website that had the report on it just simply to show -- I don't have an adequate map and I've not seen one that encompasses the whole Tierra Amarilla -- El Rito de Tierra Amarilla -- nor its section to the road. So I'm just using that as an illustration. But it is from that thing and they put -- it's the same geological that my previous speaker showed you. And those are -- I don't know if they are defunct. One of them, I think, is defunct because it's on John Sena's land and I believe it might be that one.

In other words, there's a coal mine there that hasn't been used for a number of years. And the other two, three, four, I don't -- they're not visible from the road, and I don't know what they are.

Q. Was the coal mine visibile on Sena's land when you visited his land?

A. No. He pointed to where it was. It didn't look like -- there was no discharge coming from it or identifiable.

Q. All right. If I understand, you visited three of the sites; is that correct?

A. No. I visited four. I visited the Woolley Site and both John Sena's sites and then the Trujillo site was just upstream from John's land on the Trujillo property. That's the one where the sites had been placed between the acequia and El Rito de Tierra Amarilla.

Q. Okay.

A. Okay. Do you want to go back to this?

Q. Let's go to your parameter slide.

A. Okay. The parameters of concern -- and why EPA listed that stream as impaired were turbidity, which again, the previous speaker covered. Turbidity is a measure of optical quality of the stream. There's a lot of suspended -- the more suspended material there is in the streams, the sediment or whatnot, the higher the turbidity. And they have limits that you're not to exceed.

Stream bottom deposits, they do an actual physical survey of the stream looking at what the composition in terms of particle size. And the particle sizes range from silt to sand to gravel to cobble. And I think there's more than that. They divided it up finer. And if they don't find a certain component within the stream bottom in a high quality cold water

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fishery, then they consider it impaired.

I don't know if you remember that one slide I showed right down from the Woolley Site where there was a lot of gravel in there, that is a very, very good site. A bad site would look like there was a lot of mud and sediment in it. But this can be quantitatively determined. And the temperature is just temperature.

Q. All right.

A. And the temperature, again, all of these things are on repeated dates, so they have a table in this report exceed the criteria for high quality cold water fishery.

Q. Let me see if I can ask a question here. The focus of this slide, then, is sediment runoff from erosion?

A. The existing sediment runoff from erosion and the impairment of water quality, the habitat quality for lower portion of El Rito de Tierra Amarilla.

Q. And you've inventoried -- identified sources. Is this a complete list of identified sources?

A. Yeah, this is a complete list.

Q. For all of these contributing sources, are you able to allocate on a percentage basis to each --

A. No. I can't, no.

Q. Has that been done?

A. I don't think it has. I think what they identified is what was going on in the watershed and just

listed those sources as sources of sedimentation, which they are. I don't think anybody has done a budget for those. And, in fact, it would be -- unless they did something like that universal soil loss equation which is pretty intensive.

You could more or less get a skilled practitioner like somebody from the National Resources Conservation Service to go out there and say, "Oh, look. We have headwater erosion in some of the areas. Let's start addressing those problems."

That's the level of effort that this thing done was done with.

Q. Are you telling me it's not quantifiable or it has not been quantified?

A. I don't -- it is quantifiable. It has not been quantified.

Q. Okay. What do your instincts tell you is the greatest contributor?

A. Pardon?

Q. What do your instincts tell you is the greatest contributor?

A. I don't know. I just can't estimate. Every one of those, depending on the intensity of them, again -- if you look at the universal soil loss equation, it kind of leads you to start analyzing things. Now, what is the cover in terms of vegetation of these areas? Okay. What is the slope and the slope length? Are there differences in the runoff coefficient

from the various types of soils that are in this region? And then are there difference in the rainfall patterns of this region?

And you have all of those things there. So just having those four things in my head, I can't -- and I'm not going to risk doing it without having some more information.

Q. I understand. Tell me if I asked this before: This is not a exclusive list, is it?

A. It was an exclusive list in that document. Now, if there's forest fires going on, okay, that would add to that. I'm tying to think if there is anything else that I would know of that was going on in that watershed, and there's really not. But forest fires, certainly, would add to that list.

Q. Well, for instance, we don't see the mine sites you've identified as contributing, do we?

A. They didn't either. And I assume that they may not be contributors. I think those are small mine sites. The one that John pointed to was essentially invisible in the trees.

Q. Okay. In the course of your investigation here, did you determine that there were a number of oil and gas wells in the area that you visited?

A. No. I don't think there's any oil and gas wells in this are.

Q. Did you look?

A. Well, you know, we looked around. I don't know of any permitted gas or oil wells within the El Rito de Tierra Amarilla watershed.

Q. What databases did you survey to make that determination?

A. Well, if the data is not there, then it's --

Q. So you didn't search?

A. Well, it would have popped up in the search that I did, certainly.

Q. That's not my question. What did you search?

A. Well, I looked at oil and gas, Tierra Amarilla, El Rito de Tierra Amarilla, and none of those were listed in there, so --

Q. Did you not look in the Oil Conservation Division's database?

A. I looked at a number of Oil Conservation Division things.

Q. You didn't find them?

A. No.

Q. How about New Mexico Tech? Did you look there?

A. No. I didn't look at New Mexico Tech.

Q. So you don't know whether those oil and gas sites that exist contributed to your parameters concerning -- you can't say. Can you?

A. Well, I don't -- they weren't listed here. And I

can't tell you on the basis that logic that Santa Claus isn't contributing to this thing.

Q. We're not going to blame Santa Claus --

A. Pardon?

Q. We're not going to blame Santa Claus here, are we?

A. And I don't think at this point you can blame oil and gas wells either.

Q. Right. You referred to a number of releases from the state of Colorado over several years?

A. Right.

Q. When you looked at that data, did you have the opportunity the look at volumes involved with each of those?

A. It was -- I didn't look at it, no. I mean, there's 900 and some of those. I didn't look at that. There's a lot of tabular data that's available there. And my thrust here was just to establish that there are some hazards within that hazard threat box, and nothing more. It's not meant to be a composite or exhaustive list of what has happened in Colorado nor New Mexico.

Q. Right. You're simply saying that there appears to have been contaminants and toxic substances involved in these spills. You don't go so far as to say they resulted in any sort of harm?

A. I don't remember them coming up with any actual

effects. I'm trying to think here.

Q. Okay. But you had another slide. You had an inventory of contaminants and toxic substances from the oil and gas industry. We don't need to go three, but let me ask you if --

A. Well, let's look at it.

Q. Well, let me ask you a question: Did you compile an inventory of contaminants and toxic substances from land use activities outside of the oil and gas industry?

A. Not here, no.

Q. Okay. Do you have an opinion whether drilling these wells on a closed-loop system is a good way to minimize the risk?

A. I hate -- I'm not an expert in the oil industry, you know. I've done some evaluations both in Argentina and other places, but I'm not an expert on the actual physical engineering and things like that. So I would really hesitate to start venturing into that. I did read a couple of articles on closed-loop systems where the amount of material is substantially less and the chance for spills is less. But I'm paraphrasing what I read in that article, and I don't know.

MR. HALL: No further questions.

MR. BROOKS: Okay. Any redirect?

MR. A. TRUJILLO: No, Mr. Hearing Examiner.

MR. BROOKS: Very, good. In that case, we will

excuse the witness, and we will adjourn for the evening, unless there is something of an immediate nature that needs to be raised prior to our reconvening tomorrow.

MR. T. TRUJILLO: Mr. Examiner, how much time --

UNIDENTIFIED PUBLIC MEMBER: You didn't announce when the meeting starts.

MR. BROOKS: Okay. I'm responding to two people. I will respond to Mr. Trujillo first because he's the first one I heard.

The County has 1 hour, 15 minutes remaining. Approach has 4 hours, 38 minutes remaining.

MR. A. TRUJILLO: Mr. Hearing Examiner, if I may, I'm going to lodge an objection at this point that you adhere to these time limits, because I believe that they will violate the County's fundamental rights to due process to adequately respond.

We're dealing with a case where we've already heard expert testimony from two witnesses. On Monday, we're going to hear expert testimony from probably a minimum of two, maybe three more. So to hold the County to a cross-examination of two or three expert witnesses, not to mention two or three other fact witnesses, in an hour and 15 minutes will fundamentally violate the County's rights to due process in this matter.

MR. BROOKS: Thank you, Mr. Trujillo. I will advise

you, however, that the time lines were set at the beginning of the hearing and everyone had equal knowledge of them, and I believe that that accords with due process. So I will overrule your objection. Anything further before we adjourn?

MR. HALL: No, sir.

MR. BROOKS: Very good. We will stand adjourned until 11:00 a.m. on Monday, June 23rd. The reason for the 11:00 a.m. hour is that is as early as this room is available. When you arrive here, this room may be in use. If so, we may have to wait in the hall for awhile. However, they had only reserved it until 11 o'clock. So we should be able to run them out soon.

We stand adjourned.

[Adjournment at 5:40 p.m., to reconvene at 11:00 a.m. on June 23, 3008.]

* * *

REPORTER'S CERTIFICATE

I, JOYCE D. CALVERT, Provisional Court Reporter for the State of New Mexico, do hereby certify that I reported the foregoing proceedings in stenographic shorthand and that the foregoing pages are a true and correct transcript of those proceedings and was reduced to printed form under my direct supervision.

I FURTHER CERTIFY that I am neither employed by nor related to any of the parties or attorneys in this case and that I have no interest in the final disposition of this proceeding.

Signed this 20th day of June, 2008.

JOYCE D. CALVERT
New Mexico P-03
License Expires: 7/31/08

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STATE OF NEW MEXICO)
)
COUNTY OF BERNALILLO)

I, JOYCE D. CALVERT, a New Mexico Provisional Reporter, working under the direction and direct supervision of Paul Baca, New Mexico CCR License Number 112, hereby certify that I reported the attached proceedings; that pages numbered 1-261 inclusive, are a true and correct transcript of my stenographic notes. On the date I reported these proceedings, I was the holder of Provisional License Number P-03.

Dated at Albuquerque, New Mexico, 20th day of June, 2008.

Joyce D. Calvert
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